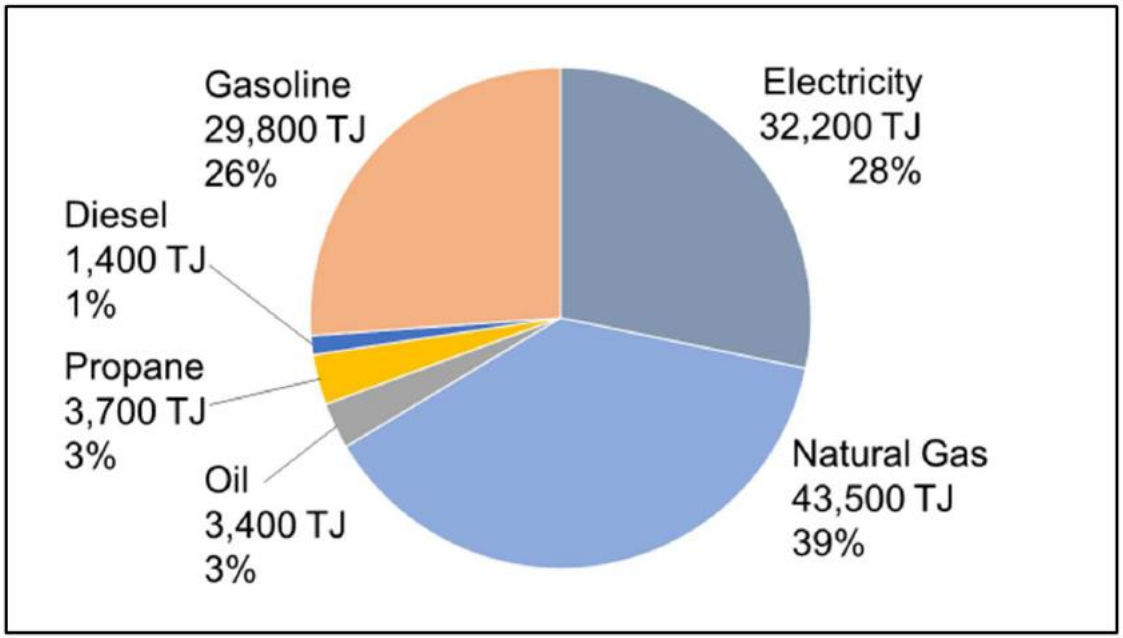
Electrical vehicle integration in the distribution grid

Ben Hazlett – Manager, Distribution Policies & Standards
November 7, 2019

INFRASTRUCTURE IS NEEDED

Figure 1 – Ottawa's 2015 energy use by supply type.



AGENDA

1. HYDRO OTTAWA & INDUSTRY
2. DISTRIBUTION SYSTEM
3. SYSTEM CAPACITY PLANNING
4. EV CHARGERS AND THEIR IMPACTS
5. CONSTRAINTS/SOLUTIONS
    - A. SUBDIVISION SERVICES
    - B. MULTI-UNIT RESIDENTIAL
    - C. MARKET SOLUTIONS

1 | OVERVIEW OF HYDRO OTTAWA

- Hydro Ottawa Holding Inc. – parent company; 100% owned by City of Ottawa; registered and incorporated under *Business Corporations Act*
- Hydro Ottawa Limited – regulated LDC, serving ~335,000 customers in the City of Ottawa and Village of Casselman
- Portage Power – Ontario's largest municipally-owned green power producer; 128 MW of installed capacity
- Envari – provider of commercial energy services (energy management, streetlighting, underground cable testing)

HYDRO OTTAWA - BY THE NUMBERS

335,320 total customers

1,116 square kilometre service area

1,441 MW peak demand in 2018

85 Hydro Ottawa and **6** Hydro One distribution stations

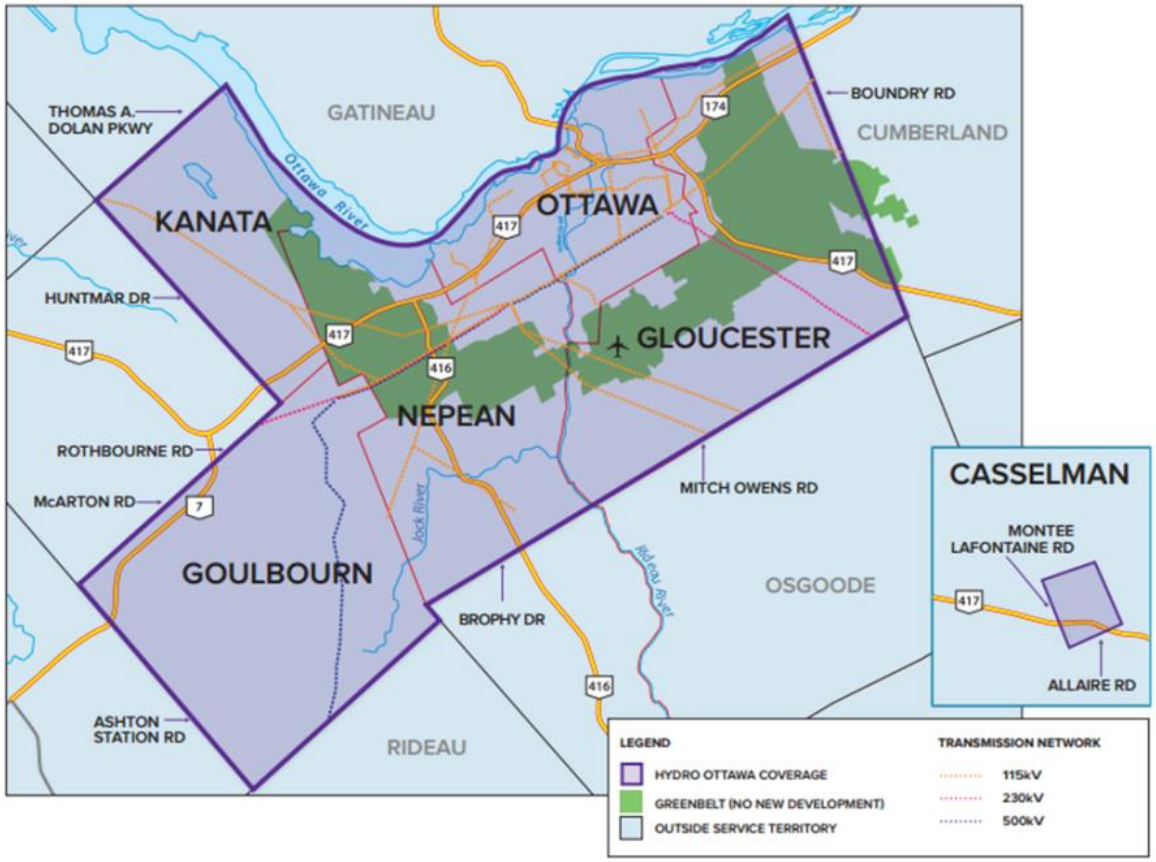
170 station class transformers

3,022 km of underground cable

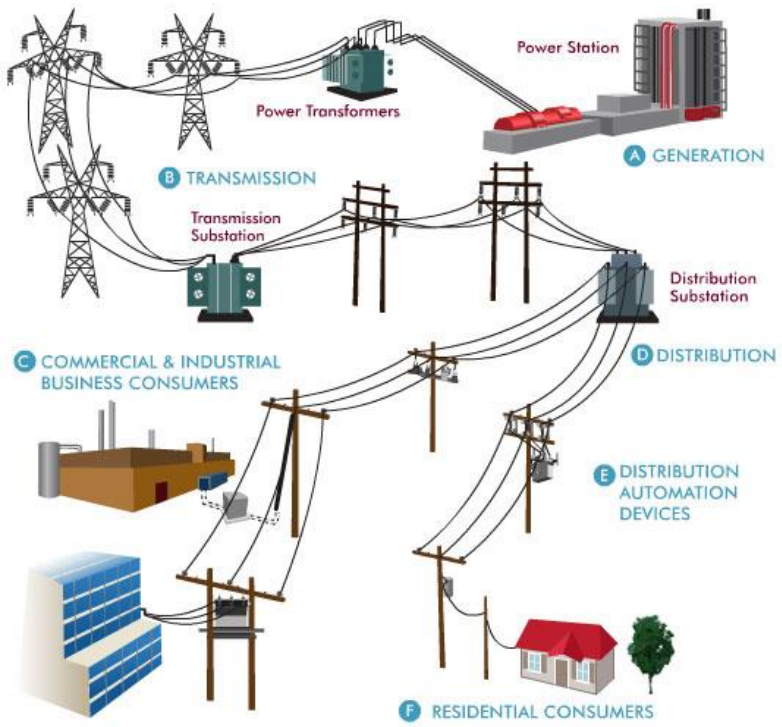
2,745 km of overhead lines

36,153 distribution transformers

48,506 hydro poles



ELECTRICAL DISTRIBUTION



(Source: srpnet.com)

- Hydro Ottawa transports power from the provincial electricity grid and distributes it across its service territory.
- The distribution network includes:
  - Substations
  - Lines
  - Transformers
  - Meters

LEGAL AND REGULATORY AGENCIES

There are three key organizations responsible for setting the policy direction of Ontario's electricity system. The decisions made by these organizations impact how utilities operate their business and serve customers.

Policy

The **Ontario Ministry of Energy, Northern Development and Mines** (MNDM) creates energy policy for the province.

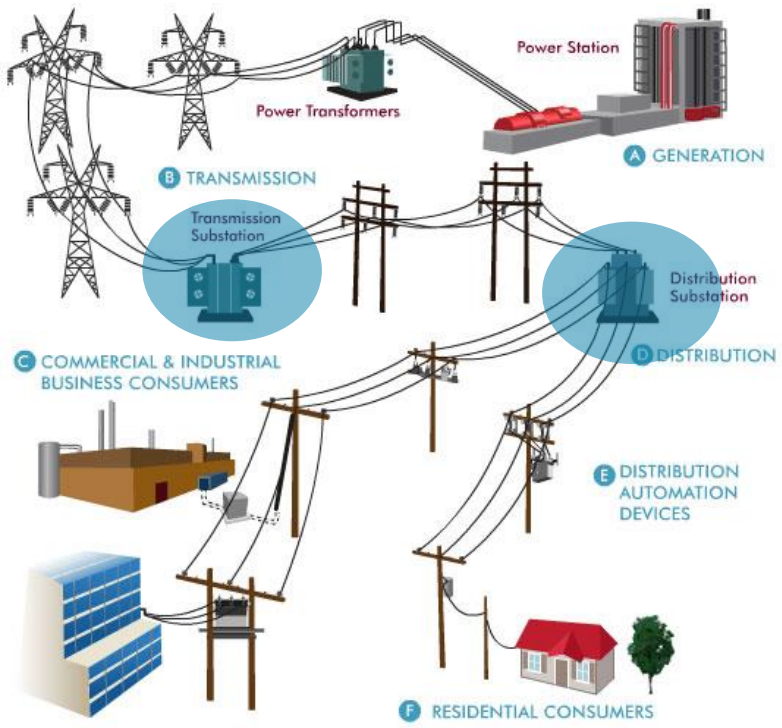
Regulation

The electricity industry in Ontario is regulated by the **Ontario Energy Board** (OEB). One of the OEB's roles is to review the business and distribution plans of all electricity distributors and approve the rates that they charge customers.

Operations and Planning

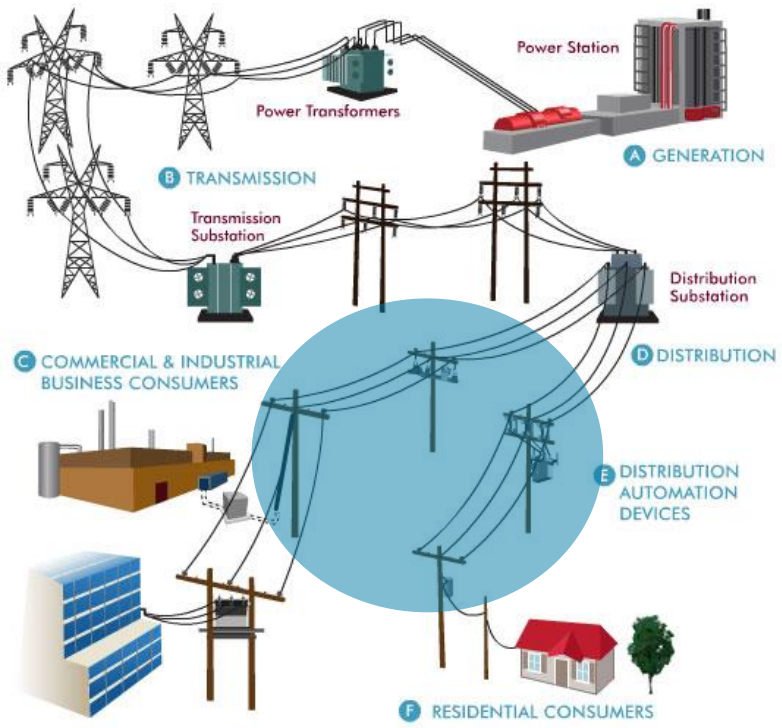
The **Independent Electricity System Operator** (IESO) manages the provincial electricity grid, plans for the province's future energy needs, and develops conservation programs.

DISTRIBUTION - SUBSTATIONS



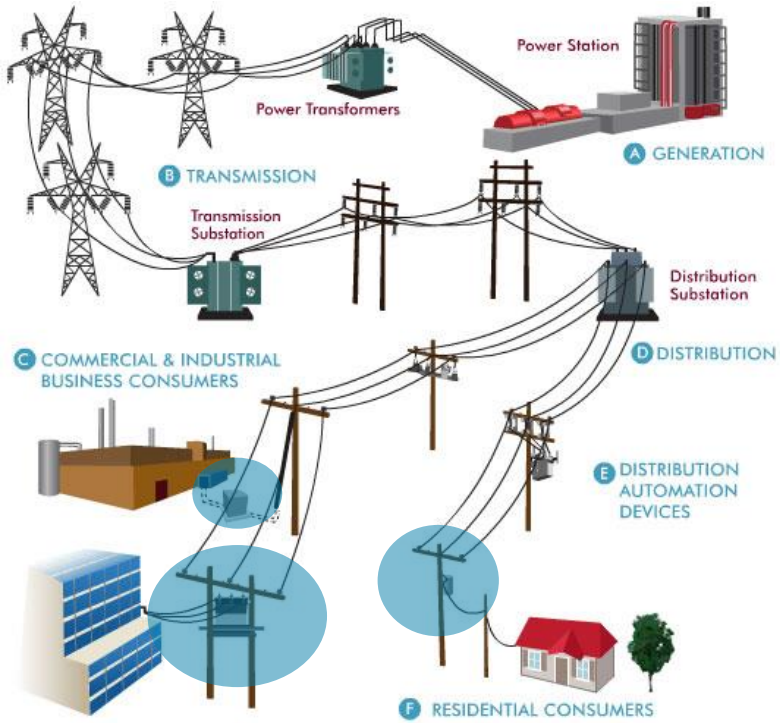
(Source: srpnet.com)

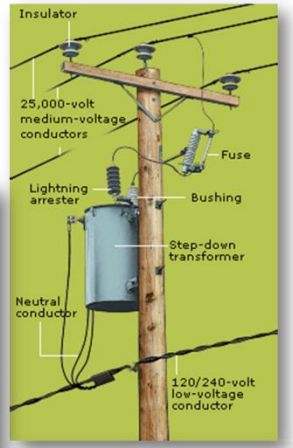
DISTRIBUTION - LINES



(Source: srpnet.com)

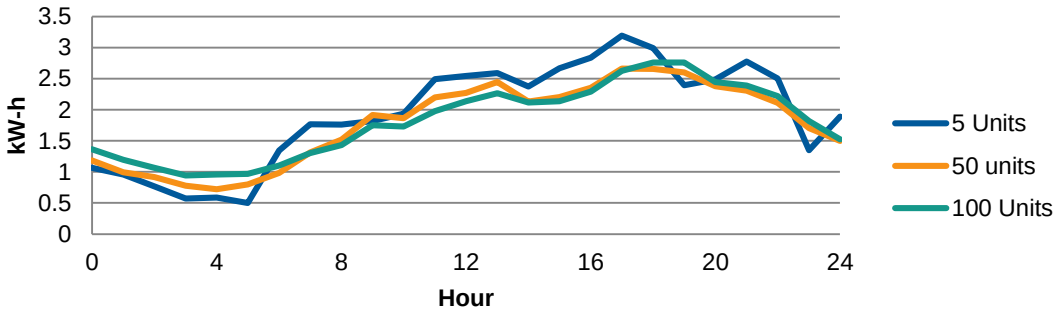
DISTRIBUTION - TRANSFORMERS

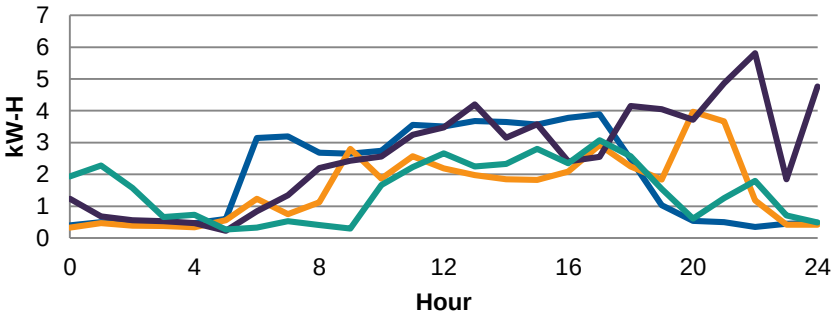




(Source: srpnet.com)

DIVERSITY AND SYSTEM PLANNING





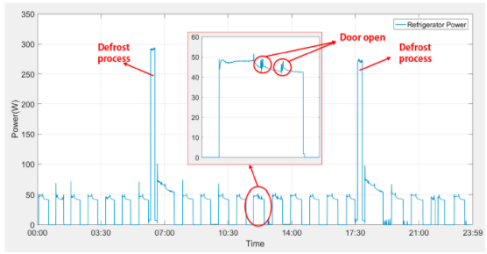


Figure 4. The daily power consumption of the refrigerator.

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CHARGING TECHNOLOGIES

- Modern day EV chargers can be categorized into 3 levels,
  - Level 1 chargers are very basic chargers that draw power in the range of 1.44 kW and 1.92 kW.
  - Level 2 charger rated power ranges from 3.1 kW to 19.2 kW.
  - Level 3 chargers range between 50 kW to 150 kW.
- Level 2 market trend to the 7.7kW, which has a time to full Charge of 4-6 hours.
- 80-90% of Charging is done at home

COMMUTER TREND IMPACTS ON SYSTEM

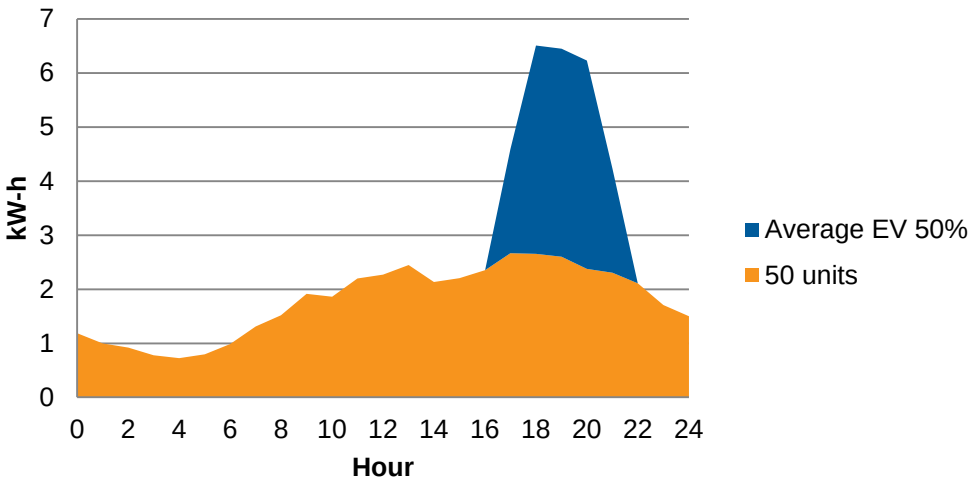
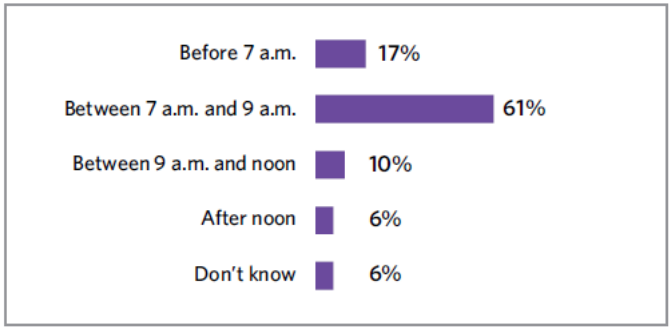
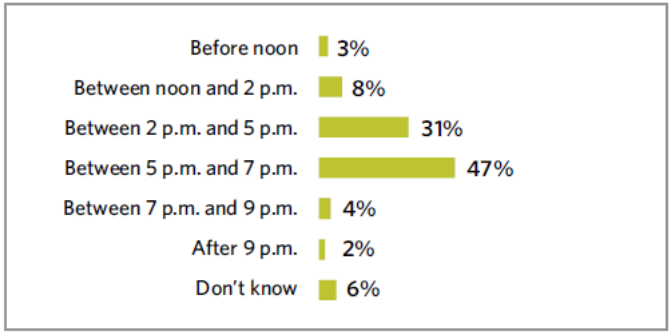


Figure 7: Time of Day When Vehicle Commuters Typically Leave Home



Subsample: Those who leave their vehicle at a specific location at least 3 days per week for at least 3 hours (N=310)

Figure 8: Time of Day When Vehicle Commuters Typically Arrive Home

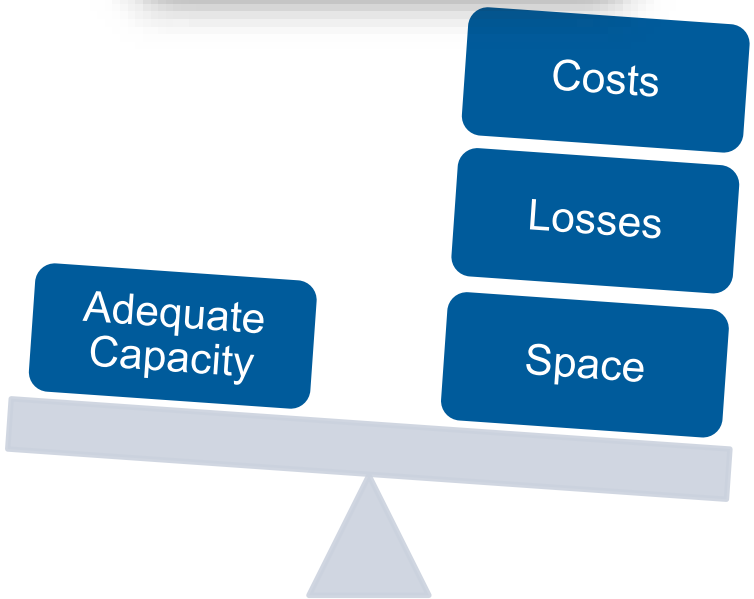


Subsample: Those who leave their vehicle at a specific location at least 3 days per week for at least 3 hours (N=310)

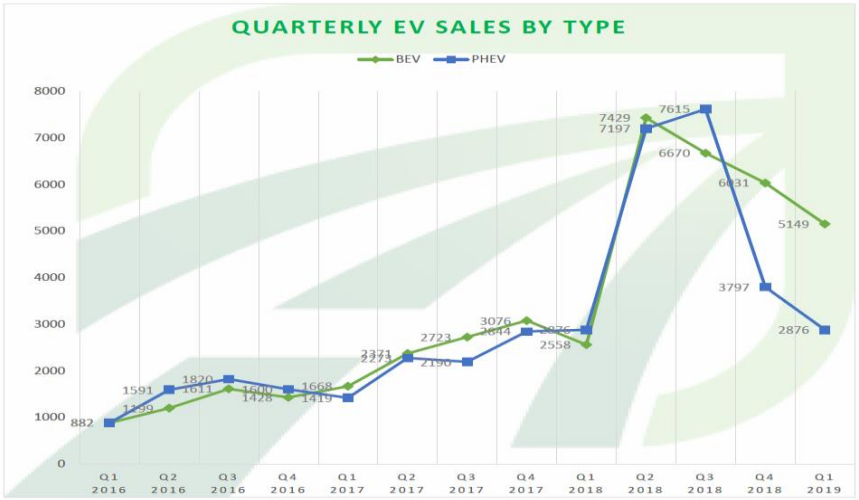
CONSTRAINTS/ SOLUTIONS

RESIDENTIAL SERVICES

- 30 Year asset
- Residential loading will change without direct LDC interface
- EV owner use will vary Case by case.
- Actual Uptake



UPTAKE OF ELECTRIC VEHICLES



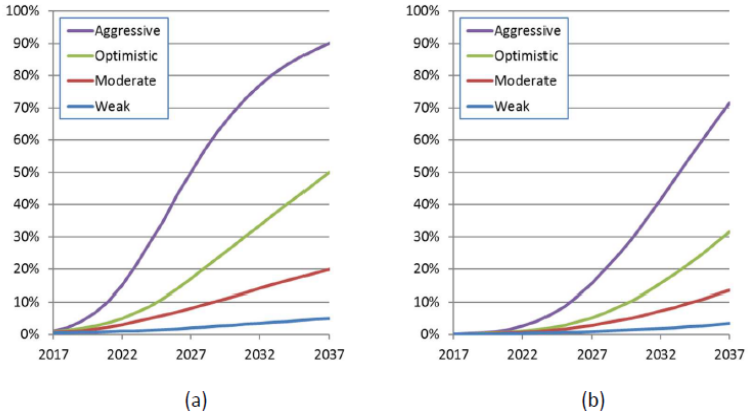


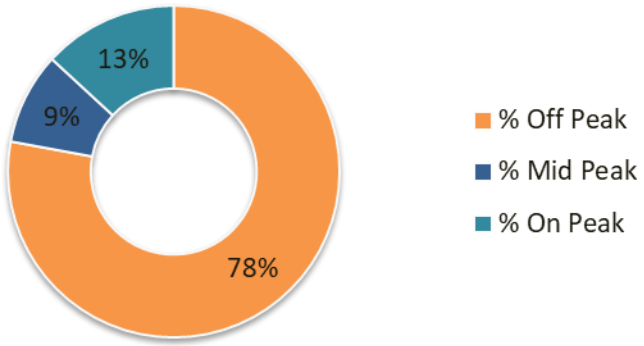
Figure 3: Penetration of EVs in (a) sales, and (b) in the fleet of light-duty vehicles in Ottawa

Table 1: EV penetration in 2037

Scenario	EV Sales in 2037	EV Fleet in 2037
Weak	5.0%	3.3%
Moderate	20.0%	13.4%
Optimistic	50.0%	31.6%
Aggressive	90.0%	71.6%

BETTER UNDERSTANDING CUSTOMERS

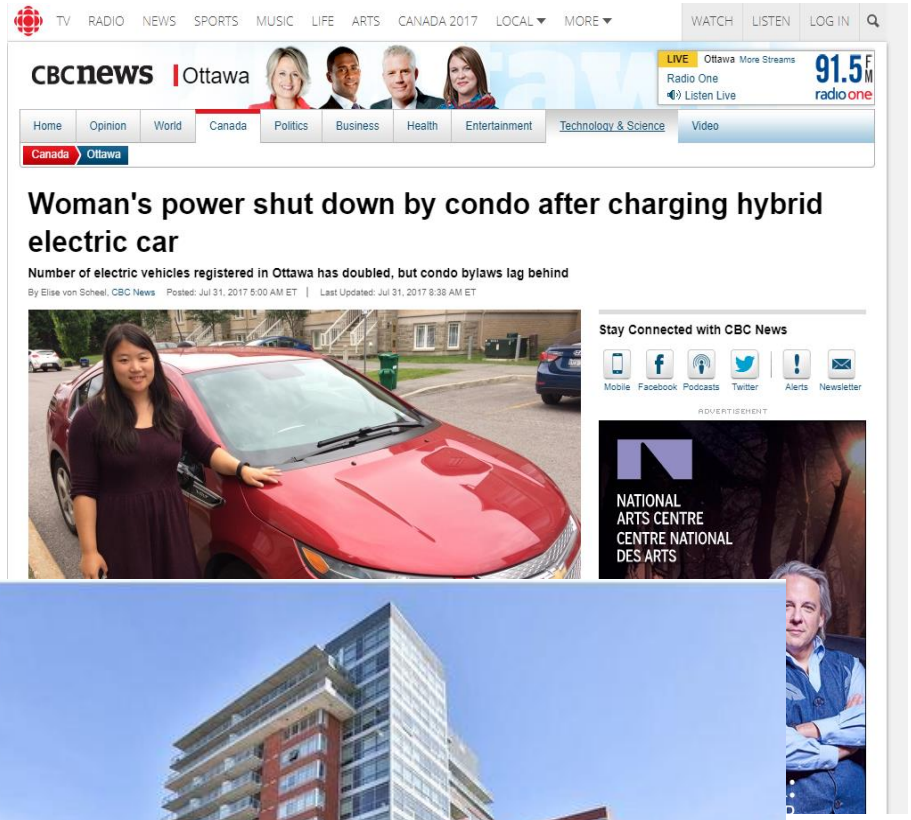
- Collaboration with other utilities
- Participation in research
  - DC Fast charging
  - EMAP
  - Residential Charging Pilot



EV Pilot Charge Periods, Summer 2019

MULTI-RESIDENTIAL

- Condominiums
- Multi-Unit Residential
- New Development
- Challenges
  - Metering
  - Electrical Capacity, upgrades and common elements
  - Parking spot Ownership
  - Location of parking spots
  - $ to invest in common elements



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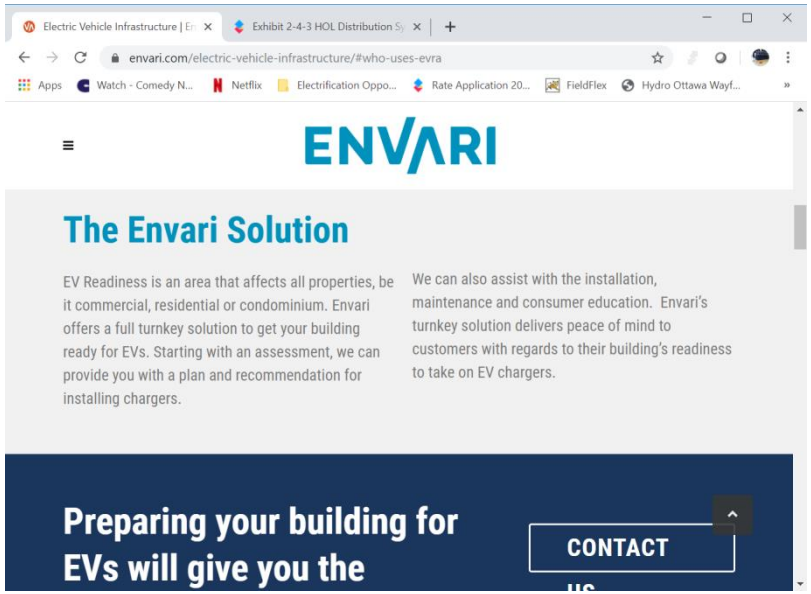
MULTI-RESIDENTIAL SOLUTIONS

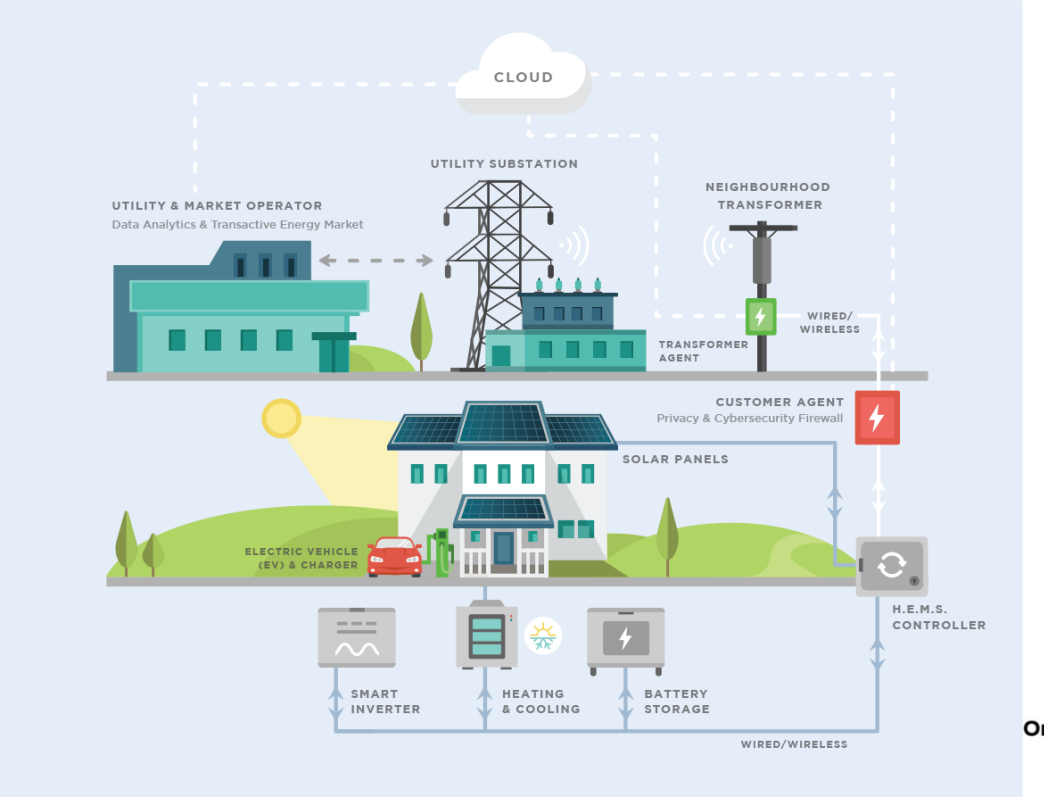
- Connection Policy Response
- New Offerings metering
- Enabling Building Owners
  - Electric Vehicle Readiness Assessment



MARKET SOLUTIONS

- There are underutilized capacity in the Grid, there are existing and growing Energy resources. Which can be utilized to balance with growing demand from Electric vehicles.
- This requires market tools, and interfaces to allow customers or there devices to receive and respond to signals from the Grid.
- Hydro Ottawa has undertaking MiGen Transactive grid: Represents the future energy marketplace – where customers generate more of their own electricity, store it, and send what is not used back to the grid

MIGEN TRANSACTIVE GRID



For details:
https://hydroottawa.com/save-energy/innovation/migen

MiGen
TRANSACTIVE GRID

Ontario · uOttawa · Carleton University · Algonquin College · EnerGate
Panasonic · EDA · IEEE · quadra power · CIMA+ · Canada
BluWave-ai · eMcREY · GET Smart Analytics Inc. · Gloucester Housing Corporation · J.L.Richards
opusone · SPARQ · Speebly · stash · THORIUM TECHNOLOGIES

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CLOSING THOUGHTS

- Electrification of transportation is and will shift significant energy delivery from the current Oil and Gas pathways onto the Electric Power Grid.
  - This will have a profound transformational impact on the grid, and infrastructure requirements.
  - This transition is being shaped by public policy.
  - Agility, considered policy, and technical solutions will be required to facilitate an affordable response to this transformation.

6 | QUESTIONS?

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